short discussion of each is included. There are numerous line drawings as in the chapters on Gymnosperms.

Three chapters at the close of the book deal respectively with apomictic embryogeny, adventitious embryogeny, and polyembryony. A glossary and indices follow. There is one index for orders and families and another for genera and species. Unfortunately there is no bibliography at the end of the entire book, literature citations being given only at the end of each chapter.

Although many will not agree with the classification that Dr. Johansen has set up, nevertheless it should act as a stimulus and point of departure for other classificatory schemes. The compilation of such a great amount of information on embryological literature between the covers of one volume is justification enough for the work. It will be of use not only to plant embryologists, but to other botanists such as cytologists, anatomists, morphologists, taxonomists, and those devoted to the study of evolution as well. Dr. Johansen is to be congratulated on furnishing them with such a wealth of information.

At present Dr. Johansen is undertaking to keep a record of species newly investigated with respect to their embryology. Because of poor library facilities he will include only those references obtained from reprints forwarded to him. Summaries will be presented from time to time in one of the regular botanical journals. Dr. Johansen can be reached at: 861 East Columbia Avenue, Pomona, California, U.S.A. He is also attempting to establish an International Commission for plant slide exchanges, and we take this opportunity to refer to this project. MARION S. CAVE, Department of Botany, University of California, Berkeley.

Manual of Phycology. An Introduction to the Algae and Their Biology. GILBERT M. SMITH, editor. The Chronica Botanica Company, Waltham, Massachusetts. xii+375 pp., 2 frontispieces, 48 figs. 1951. $7.50.

The appearance of the Manual of Phycology, long awaited by contributors as well as interested bystanders, is an event of signal importance to this branch of biology. Although there are now a number of books which deal with the algae as a whole, the Manual is unique in two respects. First, it is a cooperative undertaking in which outstanding phycologists have contributed chapters treating those phases of the field in which they are specialists. Second, the space allotted to comparative morphology and classification has been reduced to about half the total text.

The cooperative nature of the Manual has its inherent advantages and disadvantages. The summation of the training, knowledge, and experience of the contributors permits

the attainment of a degree of general excellence unsurpassed in the work of any one individual. By the same token, however, the cohesion that can result only from an integrative viewpoint is much more likely to be achieved in the work of a single author than in a cooperative undertaking. To be sure, the editor is in a position to integrate to a limited extent the various contributions, at least as far as avoiding conspicuous contradictions of interpretation and overlapping of material, and in the Manual, Gilbert M. Smith has done a job which is especially commendable considering that "within each chapter the author was given a free hand and he was the sole judge of the proportionate amounts of space to be devoted to the various sections of the chapter." Nevertheless, an over-all approach manifested in a uniform style of treatment, which noticeably reinforces such a work as Professor Smith's Cryptogamic Botany, is conspicuously, and perhaps regrettably, absent in the Manual. Consequently, the Manual will probably prove of more use as a reference book than as a textbook, which perhaps was the intention of the publisher.

The allotment of space was decided by the editor, and it is to Professor Smith's credit that aspects of phycology other than comparative morphology and classification were consigned half the total text. This does not mean that the systematics of algae, a field which is still in its infancy, is thereby de-emphasized. To the contrary, reducing systematics to its proper perspective serves to emphasize to taxonomists the need for physiological (including biochemical) and ecological approaches to the problems of systematics, entailing cultural and experimental techniques. In most universities the course in phycology is at most but one semester in length and is thus of necessity devoted largely to comparative morphology and classification with only passing reference, if any, to such dynamic aspects as algal cytology, genetics, biochemistry, and physiology (especially sexuality *per se,* photosynthesis, and morphogenesis). Surely the time has come when the recognition of the importance of algae is so general that a course in the biology in addition to the morphology of these organisms is warranted. It is hoped that in the near future the usual course in phycology will be two semesters in length and thus permit a balanced treatment of the various aspects of the science. Phycologists, as well as those persons charged with teaching phycology who are not specifically trained in the field, when planning the scope of such a course and the distribution of the lectures and laboratory assignments would do well to be guided by the Manual.

Since each author has presented his topic in such great detail and completeness that even well-trained phycologists

will find many unfamiliar but welcome facts in every chapter, the reviewer recognizes the prudence in restricting his critical comments to those phases in which he feels relatively at home.

The Manual is prefaced by a brief history of phycology, contributed by Gerald W. Prescott. In this topic, perhaps more than in any other, there is a diversity of opinion as to what should be included, depending upon the importance one assigns to the work of a given phycologist. Recognizing this diversity of opinion, one accepts as inevitable certain inclusions of seemingly unimportant information and omissions of relatively important contributions. However, one might wish for a more coherent and dynamic account. Although Prescott has covered the field in a remarkably comprehensive fashion, he shows somewhat less appreciation of the larger trends than is desirable. The omission of the development of schools of thought and of the concomitant clash of personalities has deprived this brief history of much potential interest. Cognizance of the Swedish-British and French encampments is essential to a full understanding of the history of phycology in the first half of the nineteenth century, especially the work of Turner, the Agardhs, Greville, and Harvey, on the one hand, and of Bory, Lamouroux, and Montagne, on the other. Prescott mentions many contributions in phases other than taxonomy, but systematic accounts of the history of morphology *per se*, physiology, and ecology are not given, nor are they to be found in any other chapter of the Manual. The omission in the bibliography of certain citations in the text is somewhat disturbing. These include Stackhouse (1796), Linnaeus (1737), Hedwig (1798A), Roth (1807), Roussel (1796), Braun (1835), Rabenhorst (1853), Areschoug (1875 and 1883-1884), Borzi (1879 and 1883), De Toni (1888-1905), and others.

Next, the over-all classification of algae is concisely discussed by the editor, followed by fairly exhaustive accounts of each of the major groups. The Chlorophyta are treated by M. O. P. Iyengar, the Euglenophyta by T. L. Jahn, the Chrysophyta by F. E. Fritsch, the Pyrrophyta by H. W. Graham, the Phaeophyta by G. F. Papenfuss, the Cyanophyta by Francis Drouet, and the Rhodophyta by Kathleen M. Drew. Certain of these accounts are truly scholarly. Many phycologists will undoubtedly take exception to Iyengar's classification of the siphonous green algae wherein he recognizes only the one order Siphonales. In failing to attribute ordinal importance to the fundamental process of segregative division characteristic of the Siphonocladales and to the radial symmetry and consequent vegetative elaboration peculiar to the Dasycladales, Iyengar stands in marked disagreement with leading authorities on the sipho-

nous complex, including Børgesen and Feldmann. Recent work of Dr. Lois L. Eubank, as yet published only in abstract form (News Bull. Phyc. Soc. Am., no. 3, p. 26. 1948), supports Børgesen and Feldmann rather than Iyengar. The systematic accounts are concluded by a chapter on the fossil algae, contributed by J. Harlan Johnson.

The remaining portion of the Manual, perhaps more than the portion already discussed, brings together for the first time vast quantities of information. The next seven chapters, in fact, are of the nature of reviews. Long overdue, they fill the need adequately. Comprehensive reviews are given by H. C. Bold on algal cytology, G. M. Smith on sexuality in algae, Harold H. Strain on the pigments of algae, L. R. Blinks on the physiology and biochemistry of algae, L. H. Tiffany on the ecology of freshwater algae, Jean Feldmann on the ecology of marine algae, and Bostwick H. Ketchum on plankton algae. The chapter by Blinks is especially commendable and includes an exhaustive bibliography. The omission of Hammerling's work on morphogenesis in *Acetabularia*, though regrettable, is perhaps to be attributed to the general unavailability of his papers until very recently. Following a lucid discussion of the factors which affect the distribution of marine algae, Feldmann deals with bionomic divisions and life forms. In the latter two sections he presents complex systems of terminology (which have been proposed previously). When one reads that *Caulerpa prolifera* is an "infralittoral hemicry[p]tophycean with rhizomes, psammophilic-pelophilic, eurythermic-megathermic, euryphotic, euryhaline, galenophilic [species]," one wonders whether the means have not overwhelmed the end. If one were not already familiar with *Caulerpa* from experience in the field, would one readily draw from this frightening array of terms a picture of a broadly tolerant rhizomatous alga living in protected sandy or muddy habitats in the sublittoral zone? In the brief discussion of the marine vegetation of the different parts of the world, Feldmann has regrettably omitted the highly significant results of the investigations of the intertidal ecology of South Africa, conducted by the Department of Zoology of the University of Cape Town under the direction of Professor T. A. Stephenson.

Two useful chapters are appended to the Manual. Methods for the cultivation of algae are discussed by E. G. Pringsheim, and D. A. Johansen summarizes algal microtechnique.

Dr. Frans Verdoorn and the Chronica Botanica Company are to be congratulated on having produced the Manual of Phycology. The great need for such a volume has been recognized and satisfactorily filled. Paul C. Silva, Department of Botany, University of California, Berkeley.